NOTES

Sexual Dimorphism in the Labrid Fish Genus *Gomphosus*[1]

During an examination of the viscera of Marshallese fishes the writers' attention was drawn to the fact that all of our specimens of *Gomphosus varius* in which the sex could be determined were females, and that all specimens of *G. tricolor* were males. Suspecting the possibility of sexual dimorphism, we collected additional material, so that this study of *Gomphosus* ultimately included 56 specimens from Eniwetok, 4 from Bikini, 3 from Arno (all atolls in the Marshall Islands), and 15 from Oahu and Kauai in the Hawaiian Islands. Seven Marshallese and 3 Hawaiian specimens were *tricolor*, according to various descriptions; 14 Marshallese specimens were the distinctively marked juveniles of *varius*; and the remaining 54 were typical *varius*. Eight of the 10 *tricolor* proved to be males, one was decomposed internally, and another was too immature to be sexed. Sex could not be determined for any of the 14 juvenile *varius*, but 39 of the larger specimens were females in various stages of maturity while 15 were immature and could not be sexed.

The major taxonomic difference between *tricolor* and *varius* is color and color pattern. In life *tricolor* is a rich blue-green with a vertical yellow-green bar across the trunk near the pectoral insertion. Its head and caudal fin tend to be rather more bluish than the rest of the body, and in large specimens the caudal fin is somewhat lunate. *G. varius* is somberly colored in comparison, being plain black posteriorly and creamy white to light brown anteriorly, each antero-dorsal scale having a dark spot at its base. The breast and cheeks are white or cream, the snout tip is reddish, and a narrow black stripe runs the length of the head at the level of the pupil. Small juveniles of *varius* are bright yellow-green dorsally, plain white laterally and ventrally, and have a pair of lengthwise black stripes from the snout tip to the caudal base. They also differ from larger specimens in that they either lack or are just developing the elongate snout characteristic of the genus. Jordan and Evermann (1905. *U. S. Fish Comm., Bul.* 23: pl. 36) present a color plate of *tricolor* and in the same work (*op. cit.*, p. 289, fig. 125) a black and white drawing of *varius*.

In size, our *tricolor* range from 104 to 166 mm. in standard length, whereas typical *varius* range from 38 to 134 mm. From about 30 to 40 mm. the *varius* and juvenile color patterns intergrade, our largest true juvenile measuring 36 mm. and the smallest 23 mm. Similarly, but on the other end of the scale, our smaller *tricolor* show unmistakable vestiges of a *varius* color pattern, the persistent elements being the basal dark spots on the anterior trunk scales. These spots are more obvious in preserved material than in fresh specimens but some indication of their presence occurs on all *tricolor* examined. The largest *tricolor* have slightly lunate caudal fins, a condition often appearing with age or sex in fishes, and here it is apparently restricted to the male.

Meristic data are the same for the two forms, based on 10 *tricolor* and 19 *varius*. Dorsal rays are VIII, 13; anal rays III, 11 (the first spine is imbedded) although one *tricolor* had only 10 anal rays; pectoral rays are 16, including the short bony splint at the top of the fin, with an occasional specimen having 15 or 17 rays; and lateral line scales are 27. The gill arches are C-shaped and not readily divisible into upper and lower limbs. Gill rakers totalled 24 for the first arch in the two *varius* and two *tricolor* examined for this feature.

The above facts point to the hypothesis that in the Hawaiian and Marshall Islands, at least, the species of *Gomphosus* hitherto regarded as *tricolor* and *varius* are in reality the two sexes of the same species. Apparently *tricolor* represents mature and nearly mature males while *varius* includes all females and probably also young males (even though no recognizable males were found with typical *varius* coloration). Mature males are somewhat larger than the largest fe-

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males and also tend to have lunate caudal fins. More than likely an histological examination of the gonads of small "*varius*" would show both sexes displaying the *varius* or juvenile color pattern.

Marked sexual dimorphism, expressed as coloration differences, is not unusual among the labroid fishes. Longley (Longley and Hildebrand, 1941. Papers from Tortugas Lab. 34: 196–198) showed that in *Thalassoma bifasciatum* only adult males attain the *bifasciatum* color pattern, whereas females and young males exhibit a coloration so characteristic that they were long called *T. nitidum*. Recently Randall (1955. *Copeia* 3: 237) has demonstrated that *Stethojulis renardi* is merely the adult male of *S. strigiventer*, and Brock and Yamaguchi (1954. *Copeia* 2: 154–155) have shown that *Scarus ahula* is the female of *S. perspicillatus*. The latter authors contrast the bright blue, green, and yellow pattern of male *perspicillatus* with the rather drab pattern of the female, a situation quite similar to that obtaining in *Gomphosus*.

One line of evidence which seems to cast doubt on our hypothesis that *tricolor* and *varius* are dimorphic forms of the same species is their pattern of distribution and relative abundance. In the 2-to 35-foot depth range sampled for this study *tricolor* occurred mostly in deeper water and was uncommon even there. *G. varius*, on the other hand, seemed to be uniformly distributed throughout this range and was common to abundant. Every rotenone or sight-observation station yielding *tricolor* also produced *varius*, but the reverse was certainly not true. Disjunctive distributions and aberrant sex ratios such as those found in this study do not necessarily indicate that *varius* and *tricolor* are separate species, particularly in view of Gosline and Strasburg's recent work (1956. *Copeia* 1: 9–18), on the even more markedly dimorphic Hawaiian moringuid eels.

The name to be applied to our *Gomphosus* cannot be verified at this time. *Gomphosus varius* Lacepede (1802. *Hist. Nat. Poiss.* 3:100, 104) predates *G. tricolor* Quoy and Gaimard (1824. Voyage *Uranie*, Zool.: 280), the type localities being Tahiti and the Hawaiian Islands respectively. We accordingly refer our material to *varius*, but with the following reservation. In the Indian Ocean the central Pacific forms of *Gomphosus* are replaced by two or three other species, one or two of which may be identical with the Pacific *varius*. Based on our experience it would appear that sexual dimorphism is also present in the Indian Ocean *Gomphosus*, and that males may occur as either the blue-green *tricolor* form or as a violet-blue species called *coeruleus*. The precise relationship of the Indian Ocean to the Pacific *Gomphosus* remains to be demonstrated. When this is done it may be that what we here call *varius* will be synonymized with *coeruleus*.

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DR. ELMER D. MERRILL, 1876–1956

Last year marked the passing of the outstanding bibliographer of the Pacific area, Dr. E. D. Merrill, botanist, bibliographer, and administrator; man of prodigious energy, broad vision, and deep understanding of problems and people; and a valued friend.

I wish here to pay tribute to the memory of the man to whom we owe so much. Extracts from his contributions to science were republished with subsidiary material in Chronica Botanica[1] at a time when he could still appreciate the honor. His autobiography of his Philippine and California days was published in the Asa Gray Bulletin.[2] Thus most of the essential facts concerning this leader and builder need no further elaboration.

Before December, 1928 Dr. Merrill was to me just the great man who had been Director of the Bureau of Science in Manila and who had developed Philippine botany and the great herbarium in the capital of those islands. He was the one who by then had undertaken the study of the flora of Hainan, and had stimulated the study of botany in many institutions in China, especially by the Chinese themselves. To him had gone all collections made at Lingnan University, Canton, China, where I had taught from 1922 to 1926. He was dean of the Agricultural College of the University of California in June 1928, when I became an aide in the Division of Plants, U.S. National Herbarium, Smithsonian Institution. I was employed to bring order out of the large and partly worked Chinese and other Asiatic collections. Thus I joined the ranks of the very small number of workers on the botany of China. Dr. Merrill was out front, I far in the rear. However, on a trip to Washington he came around to "look me over." With his characteristically direct question, "What are you doing about the literature?", I started with almost no previous experience in this field to become a bibliographer. A year later we became collaborators in the "Bibliography of Eastern Asiatic Botany," which left the press nearly ten years later. My association with Dr. Merrill continued until his death.

Dr. Merrill's two most outstanding characteristics were breadth of vision and limitless capacity for work. He began in Manila with nothing but his own strong qualities. Before that field was well under way he had reached out to small but important Amboina in the East Indies, unknown Borneo, American possessions in the Pacific Islands, notably Guam, and then Hainan Island and China. His influence was felt in institutions in Europe, America, and Asia. To some he is a symbol of over-extension, leaving a trail of unfinished works behind him. But he left the polish and fine points to others who could not see the need for plowing widely if not deeply, in other fields related to his own. Indeed he was extended, yet he knew this limitation. "Here it is," he said, "as far as I can do it with my limited time and resources. Let others pick up from here." So ran his philosophy. Then he turned to other things, leaving behind him, it is true, great collections named merely "by sight," but collections actually made in the first place simply because people knew that Merrill would name them. And because of his determining of these vast collections they were placed where the plodding taxonomists could get them and polish them. Nor did he stop there, but continued on, stimulating, directing and sometimes working with others on these great collections, as one can see by perusing his bibliography and noting the joint authorships. Many are the institutions in whose history Merrill's name needs major mention for his direct and indirect influence upon their growth.

Merrill's breadth of vision made him see the

[1]Merrilleana; a selection from the general writings of Elmer Drew Merrill, Sc.D., LL.D. Chronica Botanica 10(3/4): 131–393. *6 illus.* 1946.

[2]E. D. Merrill—Autobiographical: Early years, the Philippines, California. Asa Gray Bulletin N. S. 2(3/4): 335–370. *5 f.* 1953.

need for clearing up confusion in older, neglected but fundamental works. He interpreted the basic works by Blanco, Loureiro, Rafinesque, and others. He sought new collections to stand in place of important old ones no longer existing or lost. He instituted great improvements in various herbaria and seized the opportunities which fell across his path to carry on these programs. Most noteworthy of these opportunities, so far as I am aware, was the Works Progress Administration project, born of the depression in the early '30's and designed to give useful work to the unemployed. Nor did he seize this opportunity just for himself and the organization of which he was by then the Director, the New York Botanical Garden. His typists, whom he had literally by the dozen, made carbons of the original and critical descriptions, which they copied at his direction from otherwise unduplicated literature. Extra copies of these he sent to other institutions, even though at first they were often not warmly received. He realized what the WPA workers could do for the prodigious drudgery of bibliographic work and assigned the best of his staff to our joint "Bibliography of Eastern Asiatic Botany." This work is a monument to his vision and to the many devoted WPA workers whom he selected and inspired by his tirelessness and his confidence in their ability to do the job well.

I think no undertaking exemplifies his breadth of vision more than his acquisition and distribution of seeds of the now widely known *Metasequoia* from interior China. His limited funds were spent, not to take him to the haunts of this newly found "living fossil," but to enable trusted Chinese collectors to go, unencumbered by accompanying foreigners, to gather a generous supply of seeds. These were sent to Dr. Merrill, then Director of the Arnold Arboretum and Administrator of Botanical Collections at Harvard University. He distributed the seeds to institutions the world over, wherever he thought there was a chance they would be planted and cared for. Thus were determined by one extensive experiment the optimum conditions, and the range of possibilities for the growth of this most interesting remnant from the past.

Naturally Merrill left much unfinished. His sizeable book on Cook's voyages was his last finished contribution. It contains much of his distinctive and forceful philosophy, colored, as is to be expected, by the circumstances of his condition and time of life. His belief in immortality was his confidence in the enduring worth of the foundations he had laid down and the ability of others to build thereon. I take strength from the confidence expressed in his turning over to Dr. F. R. Fosberg and me his papers and interest in an eventual fourth edition of the Pacific bibliography.

Dr. Merrill's influence on botany is not ended; it continues through me and many other "Merrill-men," a designation I cherish. He wrote and worked tirelessly for his chosen subject, broadly interpreted in time and space.

Egbert H. Walker

News Notes

Ninth Pacific Science Congress

The Ninth Pacific Science Congress of the Pacific Science Association will take place in Bangkok, November 18 to December 9, 1957. It is being held under the auspices of His Majesty's Government of Thailand and the Science Society of Thailand.

Secretary-General of the Congress is Dr. Charng Ratanarat, Department of Science, Ministry of Industry, Bangkok, Thailand.

Present plans call for organization of the Congress into these divisions: Geology and Geophysics, Meteorology, Oceanography, Fisheries, Zoology, Entomology, Botany, Conservation, Museums, Soil and Land Classification, Forest Resources, Crop Improvement, Coconut Problems, Animal Improvement, Chemistry in the Development of Natural Resources, Anthropology and Social Sciences, Public Health and Medical Sciences, and Nutrition. — Pacific Science Association, Information Bulletin.

Pacific Radiocarbon Dates

An article in *Science* (124:3224, 12 Oct. 1956) presents the first set of radiocarbon dates released by Professor H. R. Crane of the University of Michigan Radiocarbon Dating Laboratory. Pacific dates include a series from Japan, Korea, China, and Manchuria, as well as from Pacific islands.

For the Pacific islands, there is a series of nine dates from materials collected for the University of California expedition, 1952, by E. W. Gifford and Dick Shutler, Jr., from New Caledonia. This is the greatest number of dates covering the longest cultural time-span that has been obtained for any Pacific island. The terminal dates are 2800 $\pm$ 350, and 615 $\pm$ 300. The oldest date, circa 844 B. C., is the earliest radiocarbon date for man in Melanesia.

The New Caledonians speak a Malayo-Polynesian language. As the linguistic relations of New Caledonian and other M-P languages in Polynesia and Melanesia are presently being worked on, it is hoped that through the method of glottochronology and the radiocarbon method it will be possible to relate the occupation of New Caledonia to both Polynesia and Melanesia.

For Fiji, (University of California expedition of 1947, E. W. Gifford), there are six dates, of which the oldest is 2000 $\pm$ 500.

For purposes of comparison, the earliest radiocarbon date for man in the Hawaiian islands is A. D. 1004 $\pm$ 180.

This series of radiocarbon dates marks a major advance in assembling a series of dates for Oceania adequate to establish the temporal framework for the human occupation of the area.—Pacific Science Association, Information Bulletin.